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(54) **DETECTION AND DETERRENCE OF COUNTERFEITING OF DOCUMENTS WITH A SEAL HAVING CHARACTERISTIC COLOR, SIZE, SHAPE AND RADIAL DENSITY PROFILE**

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(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(57) **ABSTRACT**

Detection and deterrence of counterfeiting permits one to make legitimate color copies without introducing visual artifacts or experiencing substantial processing delays. An efficient counterfeit deterrence is enabled by the use of an hierarchic detection scheme, in which the majority of documents are classified as free of suspicion using a simple characteristic color detection algorithm that imposes a negligible computational burden. The remainder of documents, which are labeled as suspicious, receive analysis by a block-based morphologic detection algorithm and then possibly other additional detection algorithms. If the suspicious document is identified as being a secure document, this will lead to printing with selectively deteriorated service or complete denial of service. For one embodiment, a seal having characteristic color, size, shape and radial density profile is incorporated into the design of frequently counterfeited documents. In the case of US currency, the already present "treasury green" treasury seal can serve as a suitable seal. The document is partitioned into appropriately sized blocks. A block is labeled suspicious if it contains the characteristic color. The scheme uses a color look-up table (LUT) to detect an initial block with a pixel having the characteristic color. A block-based morphologic detection algorithm then uses dilation to group neighboring suspicious blocks into suspicious regions. One can then examine size, shape, density, and color density profile to check each suspicious region, and to thereby verify that printing of a counterfeit is being attempted. Conventional tests for counterfeit documents can also be used as a further, higher level test.

20 Claims, 7 Drawing Sheets